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CONTRACTOR REPORT ARCCD-CR-86004

ESTABLISHMENT OF PRODUCTION LINE FOR MANUFACTURE OF 40-MM M169 CARTRIDGE CASE

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US ARMY ARMAMENT MUNITIONS & CHEMICAL COMMAND
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DOVER, NEW JERSEY

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Automated production line
40-mm M169 cartridge case

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A fully automated production line with the capacity to produce 160,000 cartridge cases per month on a 1-8-5 basis was established. A demonstration test was performed to determine the actual production capacity.

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6. EXHIBITS

1. INTRODUCTION

1.1 FACILITY PROJECT OBJECTIVE

Amron Corporation set up a cartridge case production facility with the capability of 160,000 M169 cartridge case per month on a 1-8-5 basis, as stated in Contract DAAK10-82-C-0247.

As a requirement of this contract, a demonstration test was performed to determine actual production capacity.

Amron demonstrated this production capacity on hardware Contract DAAK10-83-C-0213.

Amron demonstrated to the Government the capability on those pieces of equipment procured under this contract.

1.2 MANUFACTURING FACILITY DEVELOPMENT

Debugging of the production machinery began in March of 1983 and was completed in May of 1983. Volume case production began in June of 1983. Debugging of automation then proceeded and was completed in October of 1984. The Demonstration Test was conducted from October 3, 1984 to November 9, 1984.

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1.3 MANUFACTURING PROCESS SUMMARY

The M169 cartridge case is manufactured from extruded aluminum rod. The rod is cold sawed into slugs, which are then extruded, drawn, and headed in mechanical press operations. Heat treatment to a T4 state is next followed by vent hole drilling, machining, and anodizing.

This report provides a flow chart and description of the manufacturing process, a summary of the demonstration test and lists a problem area which was encountered. Keywords: Automated production line.

2. PROCESS DESCRIPTION

2.1 Flow Process Diagram: A simplified flow process diagram is provided (Exhibit I) indicating each step in the cartridge case production manufacturing sequence by operation title and number. Also, this diagram includes inprocess inspection stations and material handling modes.

2.2 Manufacturing Process Description: The manufacturing process description is identified for each production manufacturing sequence as shown on the simplified flow process diagram (Exhibit I) and individual process description sheets (Exhibit II).

3. SUMMARY OF DEBUG TESTING

3.1 OBJECTIVE: To evaluate the equipment, manufacturing procedures, inspection procedures, and set-up and calibration procedures for the M169 cartridge case line and modify or correct as necessary. This was done while the M169 was in production. Quality of cartridge cases produced, as well as personnel talents and equipment performance, had been established based on government acceptance of M169 cartridge cases prior to shipment to the Army Ammunition Plant.

3.2 MANAGEMENT:

Andrew J. Vargo - Program Manager, Engineer Manager
Overall project responsibility including production manufacturing process development, equipment and tooling selections.

Shirley A. Peterson - Quality Control Manager
Overall quality assurance project responsibility for all gaging and testing procedures used in the manufacturing of the M169 cartridge case. This responsibility also dictated that in process controls be established on all production operations.

3.2 MANAGEMENT: Cont'd

William P. Novak - Production Manager

Overall production responsibility by providing competent personnel and supervision to set-up, debug and operate all production equipment provided under this project. This debugging cycle had been accomplished prior to demonstration test based on the fact that all equipment provided under this project was in production use to manufacture M.69 cartridge cases for shipment to the U.S. Government.

3.3 SCHEDULE: The debugging cycle was performed on Amron's floor prior to the equipment release to production. This debugging phase has been completed on all manufacturing operations.

3.4 COST: All costs associated with the debugging cycle have been awarded under Amron's facility contract DAAK10-82-C-0247, CLIN 0001 for subject project.

3.5 DATA COLLECTION: Data collected and recorded during the debugging cycle consisted of equipment and quality problems, analyses of these problems, and the corrective action (s) taken. Equipment purchase description specifications were used in determining the final acceptance of this equipment. Corrective action was performed by the equipment vendor or Amron's personnel depending on responsibility.

3.6 GOVERNMENT SUPPORT:

Government furnished mater/government furnished equipment:

Oper. No.	Description	Equipment
20	Saw Slug	Wagner KMLN-2 Cold Saw, Govt. I.D. No.003419-21043
60	Zinc Stearate Coat	Sweco Model FMD-20-HA Vibratory Finishing Mill Govt. I.D. No.003680-00523
70	Extrusion	Danly SS1-400 Press Govt. I.D. No.003443-08756
110	Draw	Danly SA-1-100 Press Govt. I.D. No.3443-08970
120	Trim	V & O Trimmers (2) Govt. I.D. No.3449-01608 Govt. I.D. No.3449-01412
130	Head	Bliss #7 Press Govt. I.D. No.3443-08083
170	Drill Vent Holes	Drill Machines (2) Govt. I.D. No.3598-36432 Govt. I.D. No.3413-16570

Government facilities or services: None required

3.7 SUMMARY OF RATE BUILD-UP ATTAINED DURING DEBUG TESTING:

June 1983	20,000
July 1983	30,000
Aug 1983	40,000
Sept 1983	50,000
Oct 1983	60,000
Nov 1983	70,000
Dec 1983	80,000
Jan 1984	90,000
Feb 1984	100,000
Mar 1984	105,000
Apr 1984	125,000
May 1984	125,000
June 1984	90,000
July 1984	90,000
Aug 1984	125,000
Sept 1984	144,000
Oct 1984	153,600
Nov 1984	201,600
Dec 1984	201,600

4. DEMONSTRATION PLAN

4.1 OBJECTIVE:

To demonstrate to the U.S. Government that Amron Corporation, Waukesha, Wisconsin (Antigo Plant), has successfully installed a production line for the M169 cartridge case with a capacity of 160,000 units per month on a 1-8-5 hours per month basis.

4.2 PRODUCTION REQUIREMENTS:

Each piece of production equipment assigned to this project and listed in Exhibit III was demonstrated by producing a minimum of 34,415 acceptable M169 cases in thirty five (35) hours. All equipment necessary to support the prove-out of a manufacturing operation, regardless of ownership or origin, was operated during the demonstration of that operation.

4.3 EQUIPMENT MAINTENANCE PROGRAM:

4.3.1 Amron's maintenance policy for the M169 cartridge case manufacturing line provides for periodic production equipment shutdown. Shutdown is scheduled after the need for repair has been identified by the manufacturing department and assessment has been made by in-house maintenance personnel. The equipment shutdown schedule is determined by two (2) main factors: length of equipment downtime needed for this repair and the size of the storage bank needed at this operation to comply with contractual delivery schedule.

If an equipment failure requires an excessive amount of time to repair, Amron's maintenance policy includes the use of alternate production equipment from other product lines. This is permitted provided that the replacement piece of equipment is compatible with the production operation and minimal change over time is required, also authorization for use is received from the PCO.

4.3.2. The individual manufacturing operations shown on Exhibit I (Process Flow Diagram) and Exhibit II (Process Description Sheets) identify the maintenance effort to be performed on the equipment and associated tooling. This effort is defined as follows:

- - - Preventive Maintenance Schedule.
- - - Manuals:
- - - Records/Documentation.
- - - Spare Parts:

4.3.3. The Amron Corporation did not plan to demonstrate any maintenance tasks during this test program. If any equipment failure had been realized during this period, Amron's standard maintenance program would have been used.

4.4 Environmental Considerations: The Amron Corporation has four (4) manufacturing processes, used in the production of the M169 cartridge case, that are under State and Federal environmental controls.

Operation Number 30, Clean and Etch:

Equipment: Ransohoff Rotary Drum Washer, 4-Stage with Drier.

Controls:

Wastewater - - - NR101 Effluent Reporting Section 144.54 of Wisconsin Statutes.
Federal Pretreatment Regulations - 40 CFR Part 413.

Hazardous Waste - - - Federal Regulations 3004 of RCRA.
State Regulations NR181 - Hazardous Waste Management Rule.

4.4 (Cont'd)

Operation Number 80, Acid Clean:

Equipment: Ransohoff Rotary Drum Washer, 3-Stage.

Controls:

Wastewater - - - NR101 Effluent Reporting Section 144.54 of Wisconsin Statutes.

Federal Pretreatment Regulations - 40 CFR Part 413.

Hazardous Waste - - - Federal Regulations 3004 of RCRA.

State Regulations NR181 - Hazardous Waste Management Rule.

Operation 100, Deoxidize And Soap Coat:

Equipment: Advance Curing Rotary Drum Washer, 3-Stage with Drier.

Controls:

Wastewater - - - NR101 Effluent Reporting Section 144.54 of Wisconsin Statutes.

Federal Pretreatment Regulations - 40 CFR Part 413.

Hazardous Waste - - - Federal Regulations 3004 of RCRA.

State Regulations NR181 - Hazardous Waste Management Rule.

4.4. (Cont'd)

Operation Number 210, Anodize:

Equipment: ACA Anomatic, continuous belt, multiple tank, anodizing system.

Controls:

Wastewater - - - NR101 Effluent Reporting Section 144.54 of Wisconsin Statutes.
Federal Pretreatment Regulations - 40 CFR Part 413.

Hazardous Waste - - - Federal Regulations 3004 of RCRA.
State Regulations NR181 - Hazardous Waste Management Rule.

4.5. Schedule: The demonstration test schedule was as shown on *Exhibit IV, Demonstration Test Dates.*

4.6. Government Support:

4.6.1	Government Furnished Material (GFM) Government Furnished Equipment	No additional Government furnished items were required in preparation or performance of this test.
4.6.2	Government Furnished Facilities Government Furnished Services	No additional Government furnished items were required in preparation or performance of this test.

4.7 Personnel Requirements:

4.7.1 Personnel required for performance of this demonstration test have been categorized by work function. The distribution of personnel is shown below:

Personnel Category	Personnel Qty.
Production (Set-up & Operators)	8
Inspection (Patrol & Line)	4
Laboratory (Tool & Gage, Chemical)	3
Maintenance (Tooling & Equipment)	2
Support (Receiving, Shipping & Stores)	1
Supervision	2
TOTAL	20

4.8 Contractual data item requirements for the M169 facility are as defined on the DD form 1423 incorporated in contract DAAK10-82-C-0247. These data item requirements are defined below:

Sequence No.	Description of Data
A001	Final Technical Report
A002	Purchase Description
A003	Project Status Report
A004	Operational Baseline Listing
A005	Commercial Computer and Peripheral Equipment Manuals
A006	Instruction Manuals
A007	Demonstration Test Plan
A008	Drawings, Engineering Associated Lists
A009	Provisioning & Other Procurement Screening Data

4.8 (Cont'd)

Sequence No.	Description of Data
A010	Subproject Funding Report
A011	Letter Progress Reports
A012	Equipment History Data Package
A013	Inspection System Program Plan
A014	Quality Inspection Test
A015	Demonstration and Evacuation Report
A016	
A017	Ammunition Data Card
A018	Utility Inspection Unserviceable Material Report
A019	Quality Engineering Inspection
A020	Equipment Descriptive Documentation
A021	Quality Inspection Defect Report
A022	Defense Priorities and Allocations
A023	
A024	System Safety Hazard Analysis Report
A025	ECP's and RFD/W's (Short Form)
A026	Bills of Material

4.9 Demonstration Test Evaluation:

4.9.1 Representatives from the Engineering and Quality Assurance departments assisted in evaluating the results of this demonstration test.

Government personnel involved in test evaluation represented the following agencies:

ARRADCOM - Dover, New Jersey

P.B.M. - Dover, New Jersey

DCAS - Milwaukee, Wis

4.9.2 Conventional mathematics were used for the conversion and analysis of the test data. The ability of Amron to produce acceptable product at the required rates are exhibited by the data collected.

4.9.3 Amron's ability to produce at the stated manufacturing rate was demonstrated by the data collected during the test provides the basis of line acceptance.

DEMONSTRATION TEST

5.1 TEST DESCRIPTION

Amron Corporation demonstrated to the U.S. Government the capability of 160,000 units on a 1-8-5 basis, for the M169 cartridge case production line as stated in Contract DAAK10-82-C-0247.

This demonstration test was performed in the presence of the following Government representatives:

Mr. Joseph McCarthy
US Army PBMA
Dover, New Jersey

Mr. Patrick Boushon
DCASMA
Appleton, Wisconsin

The production run was performed to insure the capability of each operation at the rate specified by the Government.

Amron demonstrated the awarded capacity using hardware provided under Contract DAAK10-83-C-0213.

The Demonstration Test Schedule is shown on Exhibit IV.

During this demonstration, Amron maintained detailed records on each operation.

These records included as a minimum:

a) Number of parts produced.

b) Number of parts scrapped.

c) Test start and stop time.

d) Cause of excessive downtime.

e) Average daily production rate.

Thirty five hours of production were accumulated at each operation. In some cases where more than one identical machine was used at an operation, only one machine was demonstrated for the test. It was assumed that all identical machines would perform the same.

During the demonstration of the first several operations, a shipment of raw material was late in arriving and the demonstration had to be interrupted. This did not count as test time, and upon receipt of the raw material the test was resumed. Running out of raw material is considered a very rare occurrence on the M169 production line.

Machine downtime due to waiting for parts from a previous operation was termed administrative downtime.

5.2 DATA ANALYSIS

5.2.1 Failure data were recorded on the Prove-Out Data Collection Sheet. Notations on the sheets did not require further definition.

5.2.2. Production data were collected from part counters at mechanical operations. These same counts were used for subsequent finishing operations since the same piece parts were run through all machines in a series with no accumulation in between. Times were recorded by an observer with a stop watch.

5.2.3. Quality data were collected by charts which are a normal part of the Amron Quality Control System. Out of tolerance parts were normally produced during machine adjustments and counted by the set up person.

5.3 DEMONSTRATION TEST SUMMARY

Analysis results are listed under Exhibit V.

5.4 PROBLEM AREAS

1. No product quality problems were encountered during the test.
2. One serious mechanical problem was encountered. The lubrication system on the Sweco Vibratory Mill, Operation 60, was inoperative for two days due to a vacuum failure. Changing to a lower viscosity oil restored the machine to service, but an investigation with the manufacturer is proceeding to see if a simplier lubrication system can be retrofitted.

5.5 CONCLUSIONS

The demonstration run did net 100% of the awarded line capacity. These parts became the property of the Government through the current hardware contract and became part of the deliverable quantities.

Amron demonstrated the capability of the manufacturing operations to meet the (stated) rate by producing a minimum of 34,415 acceptable cartridge cases in 35 hours at each operation. All equipment necessary to support the prove-out of an operation, regardless of ownership or origin, was operated during the demonstration of that operation.

The ability to produce at the stated rate as evidenced by the data collected formed the basis of line acceptance.

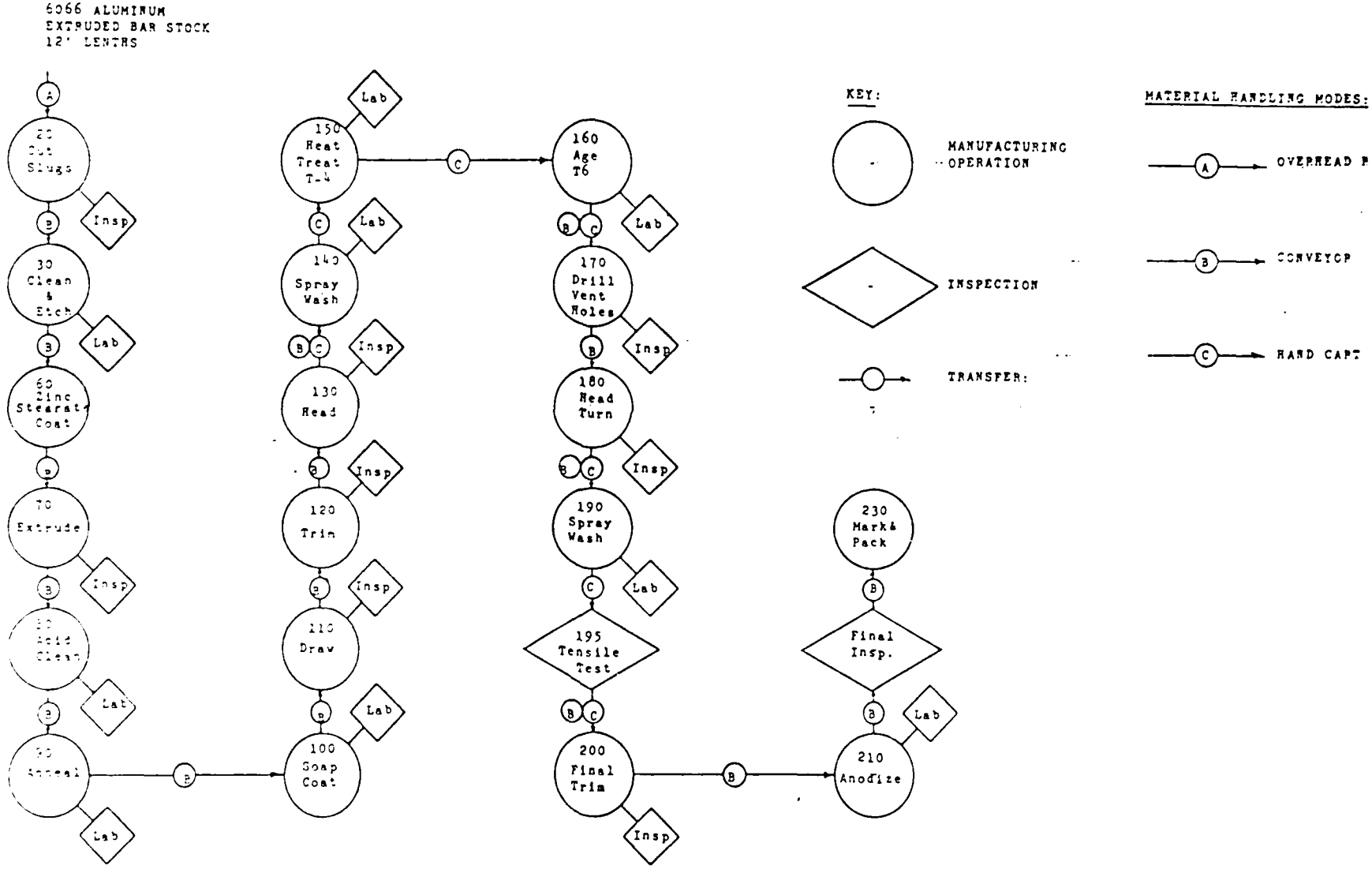
6066 ALUMINUM
EXTRUDED BAR STOCK
12' LENTHS
20 Cut Slugs
Insp
30 Clean & Etch
Lab
60 Zinc Stearate Coat
70 Extrude
Insp
Acid Clean
Lab
Anneal
Lab
100 Soap Coat
110 Draw
Insp
120 Trim
Insp
130 Head
Insp
140 Spray Wash
Lab
150 Heat Treat T-4
Lab
160 Age T6
Lab
170 Drill Vent Holes
Insp
180 Head Turn
Insp
190 Spray Wash
Lab
195 Tensile Test
200 Final Trim
Insp
210 Anodize
Lab
Final Insp.
230 Mark & Pack
KEY:
MANUFACTURING OPERATION
INSPECTION
TRANSFER:
MATERIAL HANDLING MODES:
OVERHEAD P
CONVEYOR
HAND CART

Exhibit I
21

Waukesha, Wisconsin

PROCESS DESCRIPTION

Operation Number: 20

Operation Description: Saw 12 foot by 1.830 inch diameter aluminum bars into slugs approximately .803" long. Bars are loaded on to saw table by overhead crane and cut slugs discharge automatically onto conveyor belt.

Operation Characteristic: Cold sawing extruded aluminum bars.

Equipment Description: Wagner model KMLN-2 cold saw with 14' infeed table and Bijur Mist Lubrication System; Year of Mfg. 1966.

Equipment Warranties: Expired

Calibration Requirements: Carriage speed, length of cut.

Inspection Requirements: 5 samples checked for correct weight each hour.

Certification Requirements: Material Yes Personnel _____

Manpower Requirements: Set-up: 1/2 man Patrol Inspector: 1/8 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: None

Preventative Maintenance Schedule:

Manuals: Operating Yes Maintenance _____

Records/Documentation: In process control charts
Work order system - maintenance

Spare Parts: Drive Belts
Switches
Stock Clamps

PROCESS DESCRIPTION

Operation Number: 30

Operation Description: Cartridge case blanks are automatically fed thru spiral drum type washer and are dried at the exit end.

Operation Characteristic: Alkaline clean, water rinse, caustic etch, water rinse, and dry.

Equipment Description: Ransohoff Four (4) Stage Horizontal Spiral Drum Washer with Dryer.

Equipment Warranties: Expired - Year of Mfg. 1968

Calibration Requirements: Drum speed, steam pressure, alkaline tank temperature, caustic etch temperature and dryer temperature.

Inspection Requirements: Appearance of etch
Frequency: (1) sample every 4 hours

Certification Requirements: Material _____ Personnel In-House

Manpower Requirements: Set-up: 1/5 man

Safety Requirements: Standard safety, requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vent.

Preventative Maintenance Schedule: As required.

Manuals: Operating Yes Maintenance Yes

Records/Documentation: Work order system - maintenance
Lab services

Spare Parts: Temperature Controls
Steam Coils
Trunion Wheels

Waukesha, Wisconsin

PROCESS DESCRIPTION

Operation Number: 60

Operation Description: Cartridge case blanks are automatically fed thru vibratory finishing mill filled with Zinc Stearate powered extrusion lubricant and wooden peg media.

Operation Characteristic: Coat with Zinc Stearate lubricant.

Equipment Description: Sweco model FMD-20 HA Vibratory Finishing Mill.

Equipment Warranties: Expired - Year of Mfg. 1973.

Calibration Requirements: Amount of lubricant and wooden pegs in mill.

Inspection Requirements: At daily start-up.

Certification Requirements: Material _____ Personnel In-House

Manpower Requirements: Set-up: 1/4 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Dust Collection System.

Preventative Maintenance Schedule: As required.

Manuals: Operating Yes Maintenance _____

Records/Documentation: Work Order System - Maintenance

Spare Parts: Discharge Screen
Vacuum Filters
Vacuum Pump
Vacuum Bowls

Waukesha, Wisconsin

PROCESS DESCRIPTION

Operation Number: 70

Operation Description: Cartrige case blanks are automatically fed thru extrusion press and extruded.

Operation Characteristic: Extrusion

Equipment Description: Danly SS1-400 vertical straight side mechanical extrusion press.

Equipment Warranties: Expired - Year of Mfg. 1952

Calibration Requirements: Slide adjustment, knockout pressure, parts feeder.

Inspection Requirements: Seven (7) different dimensional checks and evidence of poor workmanship (5 pieces every 30 minutes).

Certification Requirements: Material _____ Personnel In-House

Manpower Requirements: Set-up: 1/4 man Patrol Inspector 1/8 man
Utility: 1/4 man

Safety Requirements: Standard safety requirements are enforced as directed by good working practices and O.S.H.A. regulations.

Special Environmental Controls: Dust Collection System.

Preventative Maintenance Schedule:

Manuals: Operating Yes Maintenance _____

Records/Documentation: In process control charts
Work order system - maintenance

Spare Parts: Extrusion Punches & Dies
Drive Belts

Waukesha, Wisconsin

PROCESS DESCRIPTION

Operation Number: 80

Operation Description: Cartridge cases are automatically fed thru spiral drum type washer.

Operation Characteristic: Acid clean, water rinse.

Equipment Description: Ransohoff Three (3) Stage Horizontal Spiral Drum Washer.

Equipment Warranties: Expired - Year of Mfg. 1968

Calibration Requirements: Drum speed, steam pressure, acid tank temperature, rinse tank temperature.

Inspection Requirements: Cleanliness of parts
Frequency: (1) sample every 4 hours

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Set-up: 1/5 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vent.

Preventative Maintenance Schedule: As required.

Manuals: Operating Yes Maintenance _____

Records/Documentation: Work Order System - Maintenance
Lab Services

Spare Parts: Temperature Controls
Steam Coils
Trunnion Wheels

PROCESS DESCRIPTION

Operation Number: 90

Operation Description: Cartridge cases are annealed in this pot type annealing oven. Parts are loaded into pot from storage hopper. Overhead hoist positions pot in oven and then dumps pot into discharge hopper.

Operation Characteristic: Circulation of heat necessary to insure proper annealing of cartridge cases with good temperature uniformity.

Equipment Description: Despatch DT-26 natural gas pot type annealing oven.

Equipment Warranties: Expired - Year of Mfg. 1961.

Calibration Requirements: Temperature, length of cycle.

Inspection Requirements: 5 parts per load checked for hardness in lab.

Certification Requirements: Material _____ Personnel In-House

Manpower Requirements: Set-up: 1/8 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vent.

Preventative Maintenance Schedule:

Manuals: Operating Yes Maintenance _____

Records/Documentation: Base Recorder Charts - Process Control
Work Order System - Maintenance

Spare Parts: Temperature Controller
Blower Parts
Blower Bearings
Blower Motor

Waukesha, Wisconsin

PROCESS DESCRIPTION

Operation Number: 100

Operation Description: Cartridge cases are automatically fed through spiral drum type washer.

Operation Characteristic: Deoxidize, rinse, soap coat, and dry.

Equipment Description: Advanced Curing Three (3) Stage Horizontal Spiral Drum Wahser with Dryer.

Equipment Warranties: Expired - Year of Mfg. 1983.

Calibration Requirements: Drum speed, steam pressure, deoxidize tank temperature, hot water rinse tank temperature, soap tank temperature.

Inspection Requirements: Appearance of Soap Coat.
Frequency: (1) sample every 4 hours

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Set-up: 1/5 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vents.

Preventative Maintenance Schedule:

Manuals: Operating Yes Maintenance Yes

Records/Documentation: Work System - Maintenance
Lab Services

Spare Parts: Temperature Controls
Steam Coils
Trunnion Wheels

PROCESS DESCRIPTION

Operation Number: 110

Operation Description: Cartridge cases are automatically fed through draw press and drawn.

Operation Characteristic: Draw

Equipment Description: Danly SA-1-100 vertical straight side mechanical draw press.

Equipment Warranties: Expired - Year of Mfg. 1952.

Calibration Requirements: Slide adjustment, die size, parts feeder speed.

Inspection Requirements: Four (4) different dimensional checks and evidence of poor workmanship (6 pieces every 30 minutes)

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Set-up: 1/4 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls:

Preventative Maintenance Schedule:

Manuals: Operating Yes Maintenance _____

Records/Documentation: In process Control Charts
Work Order System - Maintenance

Spare Parts: Draw Punches & Dies
Drive Belts.

Waukesha, Wisconsin

PROCESS DESCRIPTION

Operation Number: 120

Operation Description: Cartridge cases are automatically fed through trimmer and trimmed to length.

Operation Characteristic: Rough trim

Equipment Description: V & O Model 983 trimmers (2).

Equipment Warranties: Expired

Calibration Requirements: Trim length.

Inspection Requirements: Two (2) different dimensional checks (6 pieces every 30 minutes).

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Set-up: 1/4 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls:

Preventative Maintenance Schedule:

Manuals: Operating _____ Maintenance _____

Records/Documentation: In process Control Charts
Work Order System - Maintenance

Spare Parts: Trim Wheels
Arbor Assemblies
Drive Belts
Bearings

PROCESS DESCRIPTION

Operation Number: 130

Operation Description: Cartridge cases are automatically fed through heading press.

Operation Characteristic: Form head.

Equipment Description: Bliss #7 horizontal toggle press.

Equipment Warranties: Expired - Year of Mfg. 1952.

Calibration Requirements: Slide adjustment, center block alignment, punch position.

Inspection Requirements: Eleven (11) different dimensional checks (5 pieces every 20 minutes)

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Set-up: 1/4 man
Operator: 1/4 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls:

Preventative Maintenance Schedule:

Manuals: Operating _____ Maintenance _____

Records/Documentation: In process Control Charts
Work Order System - Maintenance

Spare Parts: Punches & Dies
Drive Belts
Center Blocks
Slides
Crankshafts
Bearings

PROCESS DESCRIPTION

Operation Number: 140

Operation Description: Cartridge cases in wire baskets are fed through a mesh belt washer and dried.

Operation Characteristic: Alkaline clean, cold water rinse, hot water rinse, and dry.

Equipment Description: Ransohoff Three (3) Stage Mesh Belt Washer with dryer.

Equipment Warranties: Expired - Year of Mfg. 1968.

Calibration Requirements: Belt speed, steam pressure, alkaline tank temperature, rinse tank temperature, and dryer temperature.

Inspection Requirements: Cleanliness of part
Frequency: (1) sample every 4 hours

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Set-up: 1/8 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vent.

Preventative Maintenance Schedule:

Manuals: Operating Yes Maintenance _____

Records/Documentation: In process Control Charts
Work Order System - Maintenance

Spare Parts: Stack Fan Belts
Bearings
Pumps

Operation Number: 150

Operation Description: Cartridge cases in wire baskets are loaded onto grids and fed through a pusher type T-4 Quench Furnace.

Operation Characteristic: Circulation of heat necessary to insure proper solid solution treatment of metal followed by rapid water quench.

Equipment Description: Pacific Scientific pusher type T-4 Quench Furnace, natural gas fired, 3 zone control.

Equipment Warranties: Expired - Year of Mfg. 1968.

Calibration Requirements: Furnace temperature, quench tank temperature. Cycle time.

Inspection Requirements: Hardness test, chart recorder printouts
Frequency: 10 samples per grid

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Set-up: Laboratory: 1/4 man
Utility: 1/4 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vent.

Preventative Maintenance Schedule:

Manuals: Operating Yes Maintenance Yes

Records/Documentation: In process Control Charts
Work Order System - Maintenance
Recorder Charts

Spare Parts: Recorder
Controller
Bearings
Circulation Fan

PROCESS DESCRIPTION

Operation Number: 160

Operation Description: Cartridge cases in wire baskets are loaded onto carts and aged in an artificial aging oven.

Operation Characteristic: Circulation of heat necessary to insure proper artificial age hardening of cartridge cases with good temperature uniformity.

Equipment Description: Despatch model DT200 gas fired artificial aging oven.

Equipment Warranties: Expired - Year of Mfg. 1968.

Calibration Requirements: Temperature, air flow baffle adjustment.

Inspection Requirements: Hardness test, chart recorder printout, tensile strength test. Frequency: Hardness - 5 samples per rack. Tensile: 5 samples per lot

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Set-up: 1/8 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls: Outside air vents

Preventative Maintenance Schedule:

Manuals: Operating Yes Maintenance Yes

Records/Documentation: In process Control Charts
Recorder Chart
Work Order System - Maintenance

Spare Parts: Recorder
Controller
Drive Belts

PROCESS DESCRIPTION

Operation Number: 170

Operation Description: Cartridge cases are automatically fed into drill machines where vent holes are drilled.

Operation Characteristic: Drill six (6) vent holes.

Equipment Description: Three (3) special drill machines with six air powered drills on a common carrier.

Equipment Warranties: Expired - Year of Mfg. 1966 and 1968

Calibration Requirements: Carrier travel

Inspection Requirements: Five (5) different dimensional checks (8 pieces every 20 minutes).

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Set-up: 1 man Tool & Gage Lab:1/2 man
Operators: 1 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A regulations.

Special Environmental Controls: None

Preventative Maintenance Schedule:

Manuals: Operating _____ Maintenance _____

Records/Documentation: In process Control Charts
Work Order System - Maintenance

Spare Parts: Drill Bits
Drill Motors

PROCESS DESCRIPTION

Operation Number: 180

Operation Description: Cartridge Cases are automatically fed into screw machines where extractor groove and powder cavity areas are machined.

Operation Characteristic: Machine extractor groove, powder cavity, base, and trepan groove on cartridge case.

Equipment Description: 1-5/8 TA six spindle conomatics (2) with chucking mechanism conversion.

Equipment Warranties: Expired - Years of Mfg. 1950 and Unknown

Calibration Requirements:

Inspection Requirements: (28) dimensional checks
Frequency: 6 samples per machine every 30 min.

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Set-up: 3/4 man Tool & Lab: 1/2 man
Inspector: 1/2 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls: None

Preventative Maintenance Schedule:

Manuals: Operating Yes Maintenance _____

Records/Documentation: In process Control Charts
Work Order System - Maintenance

Spare Parts: Cutting Tools
Tool Holder
Collets
Spindle Bearings

PROCESS DESCRIPTION

Operation Number: 195

Operation Description: Perform tensile test per operating procedure.

Operation Characteristic: Record elongation by applying measured load input on prepared specimen.

Equipment Description: Baldwin #60 HVL Universal Testing Machine.

Equipment Warranties: Expired - Year of Mfg. 1977

Calibration Requirements: Outside Service
Frequency: Twelve (12) month cycle

Inspection Requirements: (6) samples per lot.

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Metallurgy Lab: 1/8 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls: None

Preventative Maintenance Schedule:

Manuals: Operating Yes Maintenance _____

Records/Documentation: Calibration

Spare Parts:

AMRON CORPORATION
Waukesha, Wisconsin

PROCESS DESCRIPTION

Operation Number: 200

Operation Description: Cartridge cases are automatically fed through a rotary table trimming machine.

Operation Characteristic: Final trim to length, mouth size, and chamfer.

Equipment Description: M.S.O. three station rotary table trimming machines (2).

Equipment Warranties: Expired - Year of Mfg. 1963 and 1966

Calibration Requirements: Travel of cutting heads, position of cutting tools.

Inspection Requirements: (6) dimenstional checks
Frequency: (6) samples each 30 minutes

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Set-up: 1/4 man
Inspector: 1/8 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regualtions.

Special Environmental Controls: None

Preventative Maintenance Schedule:

Manuals: Operating Yes Maintenance _____

Records/Documentation: In process Control Charts
Work Order System - Maintenance

Spare Parts: Cutting Tools
Collets
Bearings
V-belts

Waukesha, Wisconsin

PROCESS DESCRIPTION

Operation Number: 210

Operation Description: Cartridge cases are hand loaded, fed through belt type anodizing line, and hand unloaded.

Operation Characteristic: Deoxidize, rinse, etch, rinse, de-smut, rinse, anodize, rinse, dye, rinse, seal and dry.

Equipment Description: A.C.A. titanium belt anodizing line-eleven (11) tanks and dryer section.

Equipment Warranties: Expired - Year of Mfg. 1969.

Calibration Requirements: Belt speed, anodic coating thickness.

Inspection Requirements: Anodic coating, salt spray test
Frequency: Anodic coating (5) samples each 15 minutes
Salt Spray Test (1) sample each 8 hours
Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Set-up: 1/2 man Laboratory: 1/2 man
Operator: 1½ man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls: Fume Scrubber

Preventative Maintenance Schedule:

Manuals: Operating _____ Maintenance _____

Records/Documentation: In process Control Charts
Recorder Chart
Work Order System - Maintenance

Spare Parts: Titanium Belts
Part Racks
Bearings

Waukesha, Wisconsin

PROCESS DESCRIPTION

Operation Number: 230

Operation Description: Cartridge cases are automatically fed through a marking machine and stamped with identification characters.

Operation Characteristic: Mark with identification characters.

Equipment Description: Kiwi Coding machine with (2) turntables and automatic inker.

Equipment Warranties: Expired - Year of Mfg. 1983.

Calibration Requirements: Coder speed, stamp location

Inspection Requirements: Stamp appearance and location
Frequency: (6) samples each 30 minutes

Certification Requirements: Material _____ Personnel In-house

Manpower Requirements: Inspector: 1/8 man

Safety Requirements: Standard safety requirements are enforced as directed by Good Working Practices and O.S.H.A. regulations.

Special Environmental Controls: None

Preventative Maintenance Schedule:

Manuals: Operating Yes Maintenance _____

Records/Documentation: Work Order System - Maintenance

Spare Parts: Inking Wheel

EQUIPMENT DEMONSTRATED FOR 160,000/MO. CAPABILITY

Operation No.	Operation Description	Equipment Description	Amron Tag No.	Ownership (Govt Furnished or Contractor)	Equipment Cycle Rate (100% Efficient) (Parts Per Hour)	Rate Demonstrated (Parts Per Hour)
020	Cut Slugs	Wagner KMLN-2 Hydraulic Cold Saw W/automatic infeed table	4956	GFM	1,440	1,056
025	Cut Slug Inspection					
030	Clean & Etch	Ransohoff (4)Stage Spiral Drum Washer W/Heated Dry-off section	2884	C	17,500	1,056
060	Zinc Stearate Coat	Sweco Model FMD-20-HA Vibratory Finsihing Mill	4963	GFM	18,000	1,056
070	Extrusion	Danly #SS-1-400 Straight Side Mechanical Extrusion Press	4966	GFM	1,800	1,056
075	Extrusion Inspection					
080	Acid Clean	Ransohoff (3)Stage Spiral Drum Washer	2857	C	25,000	1,056
090	Anneal Condition "O"	Despatch Gas-Fired re-circulating oven	765	C	1,962	1,056
095	Anneal Inspection					
100	Deoxidize & Soap Coat	Advanced Curing (3)Stage Spiral Drum Washer w/heated Dry-off section	4959	GFM	8,500	1,056
110	Draw	Danly #SA-1-100 Straight side Mechanical Press	4965	GFM	3,600	1,056
115	Draw Inspection					
120	Trim	V & O Trimmers Model #983 w/Trim Arbor & Rotating knife (2 required)	2425 2134	GFM GFM	2,100 2,300	528 528
125	Trim Inspection					
130	Head	Bliss #7 Horizontal Double Crankshaft Mechanical Press	4964	GFM	2,820	1,056
135	Head Inspection					

EXHIBIT III

EQUIPMENT DEMONSTRATED FOR 160,000/MO. CAPABILITY

Operation No.	Operation Description	Equipment Description	Amron Tag No.	Ownership (GC Furnished or Contractor)	Equipment Cycle Rate (100% Efficient) (Parts Per Hour)	Rate Demonstrated (Parts Per Hour)
140	Spray Wash	Ransohoff (3)Stage Mesh Belt Conveyor type Washer w/cold air dryoff	2873	C	24,300	1,056
150	Solution Heat Treat T4	Pacific Scientific Gas Fired Pusher type Quench Furnace	2885	C	6,480	1,056
155	T-4 Inspection					
160	Artificial Age T-6	Despatch Model DT200 Gas Fired Artificial Age Oven	2881	C	1,388	1,056
165	T-6 Inspection					
170	Drill Vent Holes	Special Design Air Driven 6-Spindle Drilling Machine W/rotary Index Table (3 Req'd)	2409	GFM	1,020	352
			2253	GFM	1,020	352
			2806	C	1,020	352
175	Vent Hole Inspection					
180	Head Turn	1-5/8-TA 6-Spindle Conomatic Chucking type Screw Machine (2 Required)	1977		660	528
			1995		660	528
185	Head Turn Inspection					
190	Spray Wash	See Operation #140				
195	Tensile Test	Baldwin #60 HVL Universal Testing Machine	4405	C		
200	Final Trim, Size & Chamfer	M.S.O. Vertical Head Trimming Machine w/rotary Index Table (2 required)	2712	C	1,020	528
			2381	C	1,020	528
210	Anodize	A.C.A. Titanium Belt Type Anodize line	3352	C	4,500	1,056
215	Anodize Inspection					
220	Final Inspection (Salt Spray)	Salt Spray Cabinet	4998	GFM		
230	Mark & Pack	Kiwi Coder Part Inking Machine	4999	GFM	3,960	1,056

EXHIBIT III

M169 Cartridge Case

OPERATION NUMBER	OPERATION DESCRIPTION	TEST DATES
020	Cut Slugs	10-3-84 / 10-12-84
030	Clean & Etch	10-3-84 / 10-12-84
060	Zinc Stearate Coat	10-3-84 / 10-12-84
070	Extrusion	10-3-84 / 10-12-84
080	Acid Clean	10-3-84 / 10-12-84
090	Anneal Condition "O"	10-3-84 / 10-15-84
100	Deoxidize & Soap Coat	10-12-84/ 10-25-84
110	Draw	10-12-84/ 10-31-84
120	Trim	10-12-84/ 10-31-84
	Trim	10-12-84/ 10-31-84
130	Head	10-12-84/ 10-25-84
140	Spray Wash	10-12-84/ 10-19-84
150	Solution Heat Treat T-4	10-12-84/ 10-30-84
160	Artificial Age T-6	10-12-84/ 10-19-84
170	Drill Vent Holes	10-24-84/ 11-01-84
180	Head Turn	10-24-84/ 10-31-84
	Head Turn	10-24-84/ 10-30-84
190	Spray Wash	10-12-84/ 10-19-84
200	Final Trim, Size & Chamfer	11-01-84/ 11-15-84
	Final Trim, Size & Chamfer	11-01-84/ 11-15-84
210	Anodize	10-18-84/ 10-30-84
220	Final Insp.(Vent Hole Inspection)	11-01-84/ 11-09-84
230	Mark & Pack	11-01-84/ 11-09-84

5.5 DEMONSTRATION TEST SUMMARY

OPER. NO.	OPERATION DESCRIPTION	MACHINES QTY ON HAND	MACHINES QTY IN TEST	OBSERVED AVAILABILITY	REJECT RATE[2]	REQUIRED RATE[1,3]	OBSERVED RATE[3]
020	Cut Slugs	1	1	0.950	0	16.4P.P.M.	24.65
030	Clean & Etch	1	1	1.000	0	16.4P.P.M.	35.44
060	Zinc Stearate Coat	1	1	0.684	0	16.4P.P.M.	35.10
070	Extrusion	1	1	0.927	0	16.4P.P.M.	32.24
080	Acid Clean	1	1	1.000	0	16.4P.P.M.	32.82
090	Anneal Condition "0"	1	1	1.000	0	16.4P.P.M.	29.74
100	Deoxidize & Soap Coat	1	1	1.000	0	16.4P.P.M.	43.81
110	Draw	1	1	.909	.00013	16.4P.P.M.	64.57
120	Trim	2	2	.981 .987	0 0	8.2P.P.M. 8.2P.P.M.	33.11 33.77
130	Head	1	1	.969	.000062	16.4P.P.M.	44.74
140	Spray Wash	1	1	1.000	0	16.4P.P.M.	77.59
150	Solution Heat Treat T-4	1	1	1.000	0	16.4P.P.M.	55.18
160	Artificial Age T-6	1	1	1.000	0	16.4P.P.M.	27.88
170	Drill Vent Holes	3	1	1.000	.00010	5.47P.P.M.	15.30
180	Head Turn	2	2	.984 .794	.00098 .00096	8.2P.P.M. 8.2P.P.M.	10.88 9.08
190	Spray Wash						

1. REQUIRED TO MEET FACILITY DESIGN PRODUCTION RATE.
2. PERCENT RATE = 1.(NO GOOD PIECES(NO REWORK) /TOTAL PRODUCED) 100
3. PIECES/HR OR SHIFT,ETC.

EXHIBIT V

OPER. NO.	OPERATION DESCRIPTION	MACHINES QTY ON HAND	MACHINES QTY IN TEST	OBSERVED AVAILABILITY	REJECT RATE[2]	REQUIRED RATE[1,3]	OBSERVED RATE[3]
200	Final Trim, Size & Chamfer	2	2	.973 .974	.00049 .00063	8.2P.P.M. 8.2P.P.M.	18.48 19.33
210	Anodize	1	1	1.000	0	16.4P.P.M.	35.58
220	Inspect Vent Holes	2	1	.993	.03647	8.2P.P.M.	21.38
230	Mark & Pack	1	1	.994	0	16.4P.P.M.	20.50

1. REQUIRED TO MEET FACILITY DESIGN PRODUCTION RATE.
2. PERCENT RATE = 1.(NO GOOD PIECES(NO REWORK) /TOTAL PRODUCED) 100
3. PIECES/HR OR SHIFT,ETC.

EXHIBIT V

DISTRIBUTION LIST

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